LSDT
Internal SCSI Option
Operators' Supplement
Manual

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1. Introduction

This document is intended to describe the unique features of the Internal SCSI Option on LSDT scanners. This is not a replacement for the “Operators’ Reference Guide”.

2. System Description

The Internal SCSI Option is composed of a standard LSDT scanner with an embedded microprocessor based controller. The unit’s external interfaces consists of a SCSI 2 connector, RJ-11 serial connector, and a rotary switch for selecting the SCSI ID. The scanner control program running on the internal microprocessor board provides the interface between the host commands coming from the SCSI bus and the scanner hardware.

During a scan operation, image data from the scanner is buffered in a circular buffer on the controller. The circular buffer is 4MB or optionally 16MB. If the host computer fails to read the image data in a timely fashion a data lost error will occur. This data lost error is unique to the internal SCSI option. The older external SCSI option was always configured with enough internal memory to buffer a complete image.

3. Installation

Please refer to the “Operators’ Reference Guide” section 2 for general unpacking and setup. However ignore the sections 2.2.4 “Installation of Data Control Board (DCB)” and 2.2.4 “Installation of Control Interconnect Cable”

Installation of the LSDT scanner with internal SCSI option should be easy. Plug in the scanner power, attach the SCSI cable and select the SCSI ID and the system is ready to scan. Depending on the host system software the scanner configuration file may need to be modified using the serial interface.

3.1 SCSI Cabling

The scanner has a 50 pin SCSI-2 connector. Connect directly from the host interface card or another SCSI device.

3.2 SCSI ID and SCSI TERMINATION

There is a small rotary switch on the back of the scanner next to where the SCSI cable is connected. This switch selects both the SCSI ID and enables SCSI bus termination. SCSI ID's range from 0 through 7. **Every device on the SCSI bus must have a unique ID**. The switch rotates from "**0**" to "**F**". Switch values from 0 through 7 select SCSI ID = value, with bus termination DISABLED. Switch values from 8 through F select SCSI ID = (value - 8), with bus termination ENABLED. For example if the rotary switch is set to "C" then the scanner will respond to SCSI ID 4 with the SCSI bus termination enabled.

Switch position	SCSI ID	Termination enabled
0	0	NO
1	1	NO
2	2	NO
3	3	NO
4	4	NO
5	5	NO
6	6	NO
7	7	NO
8	0	YES
9	1	YES
A	2	YES
B	3	YES
C	4	YES
D	5	YES
E	6	YES
F	7	YES

3.3 Hardware Configuration

Normally no hardware configuration is required. The microcontroller interface board has 4 jumpers (JP1, JP2, JP3, JP4). Jumper JP1 is really a connector for a reset button, if jumped the system will not run (constant reset). Jumpers JP2 and JP3 are used to configure the memory size. Jumper JP4 enables the SCSI bus state indicator LEDs. When JP4 is enabled the LEDs show the current SCSI bus state. Since the LEDs are located inside the scanner they are only used for trouble shooting.
WARNING: If JP4 is enabled the LEDs will cause stray light that will adversely effect the image quality.

System Memory Configuration Jumpers

JP2	JP3	Memory size	
1-2	1-2	1MB	(1MB is NOT enough to run the scanner)
2-3	1-2	4MB	
2-3	2-3	16MB	

3.4 Scanner Configuration (LSDTCONF.DAT)

The scanner has several minor configuration options. The file D:\LSDTCONF.DAT on the internal controller defines all user configuration options. There are 7 option parameters: protocol, inquiry type, target SCSI ID, wait for digitize, mode, film present, and request sense length. The meaning and syntax of each parameter is described in the following sections. The factory default settings are correct for the majority of users.

Example LSDTCONF.DAT file:

```
Protocol                LUMISYS     ; LUMISYS or ANSI
Inquiry_Type            ANSI        ; LUMISYS or ANSI
TARGET_SCSI_ID          4           ; from 0 through 6 are valid
WAIT_FOR_DIGITIZE       FALSE       ; either TRUE, or FALSE
                                    ; TRUE -> more like LS150/200
MODE                    NORMAL      ; INTERRUPTABLE/NORMAL
                                    ; INTERRUPTABLE returns busy
                                    ; on image data reads when no
                                    ; data is available. Host must
                                    ; retry.
                                    ; NORMAL holds the SCSI bus
                                    ; until data is available.
FILM_PRESENT            NO          ; TRUE or YES if sensor present
REQ_SENSE_LENGTH        0           ; Non-Zero overrides response length
```

3.4.1 Protocol

This parameter selects the scanner command protocol, currently only “LUMISYS” is supported.
Default = LUMISYS

3.4.2 Inquiry Type

This parameter selects the format of the Inquiry response data. Legal values are “LUMISYS” or “ANSI”. It is highly recommended that “ANSI” be used. The correct value is determined by the host software. Some host software will except either format.
Default = ANSI

3.4.3 Target SCSI ID

NOT USED This parameters is provided only for compatibility with previous version of the scanner. The SCSI ID is set ONLY using the rotary switch at the back of the scanner.

3.4.4 Wait for Digitize

This parameter determines the behavior of the scanner when a Digitize command is received. Legal values are “TRUE” or “FALSE”. Most host systems prefer FALSE, but a value of TRUE cause a more LUMISCAN 150/200 like behavior.
Default = FALSE

3.4.5 Mode

This parameter determines the behavior of the scanner when a Receive Data command is processed and the is no data currently available. Legal values are “NORMAL” or “INTERRUPTABLE”. A setting of NORMAL causes the SCSI bus to be held busy while waiting for the image data. While the SCSI bus is held no other SCSI device can be accessed during the 8+ seconds that it takes to load the film for scanning. A setting of INTERRUPTABLE returns a BUSY condition and the host must poll until data is available. Most systems will scan correctly with either value, but general host system performance could be affected. The correct value is determined by the host system.
Default = NORMAL

3.4.6 Film Present

The setting of the parameters indicates to the scanner the presence of a film present sensor in the hardware. The factory value for this parameters should not be changed except by a field service person installing a hardware upgrade.
Default = (depends are actual hardware, TRUE if detector is present in hardware)

3.4.7 Request Sense Length

This parameter allows the length of the response to a “Request Sense” command to be overridden. The correct value is determined by the host software. Don’t change this parameters unless your host software requires it.
Default = 0

4. Diagnostics

There are several diagnostic and maintenance programs that may be executed to keep the scanner performance optimal. At this time all diagnostics must be run by using internal "command line utilities". To access the microprocessor a terminal, or a computer running a terminal emulation program, should be connected to the serial port.

4.1 Serial Port Setup

At the back of the scanner, next to the SCSI connector is a phone jack (RJ-11) connector for an RS-232 serial line. This serial line uses a "3 wire" connection. Only the transmit, receive, and ground wires are used. This port is set for 9600 baud, 8 bits, No Parity, 1 stop bit. (Note: some systems may be set to 56K baud). The serial port is used to access the internal microcontroller for system configuration, maintenance, and diagnostics.

4.2 Scanner Control Program

Normally when the scanner is powered on the main control program is executed. The main program is named "LSDTISO.EXE". For historical reasons it is sometimes called LSDTSCSI. The LSDTISO program takes command input from the SCSI bus and translates it into control operations for the scanner hardware. Image data is taken from the scanner hardware, buffered in onboard memory, and then sent to the host.

When a terminal is attached to the serial port, input is received and process by the control program. The LSDTISO program accepts several single key commands: X, O, D, F, L, and Q. These commands are case sensitive.

'X' - dump internal SCSI interface chip registers
'O' - display status of internal FIFO error flag (good or overflow)
'D' - enable/disable screen debugs (toggle), internal program status info
'F' - enable/disable SCSI commands (toggle), data, and status display
'L' - dump internal DMA controller registers [CAN CAUSE ERRORS]
'Q' - quit program, exit to command line prompt.

Note: the 'L' command can cause data loss and other errors if used while the scanner is transferring data, DMA active.

Normally only the 'Q' quit command is used to get access to the command line diagnostics.

Sometimes the 'F' Formatted SCSI data dump command may be used to try and diagnose system setup of host programming problems.

Sample 'F' Debug Output

```
[SCSI command bytes]  : [data]                                    ; [status code]
0A 00 00 00 02 00  : 10 00                                        ; 00
0A 00 00 00 0B 00  : 06 00 00 00 00 36 B0 42 68 09 B7             ; 00
0A 00 00 00 09 00  : 02 01 49 05 C4 01 00 04 91                   ; 00

0A 00 00 00 02 00  : 10 01                                        ; 00
0A 00 00 00 0B 00  : 06 00 00 00 00 18 6A 1E A9 04 7D             ; 00
0A 00 00 00 09 00  : 02 01 49 05 C5 01 00 04 92                   ; 00
```

4.3 Command Line Maintenance and Diagnostics Utilities

The command line utilities are access through the serial interface. After connecting to the serial port, type 'Q' to cause the control program "LSDTISO" to exit. When the "**D:**\>" prompt appears the utilities are ready to run. A subset of standard DOS commands are available. When you are finished with the utilities either reboot the system by power cycling, or run the LSDTISO program.

NOTE: Do **NOT** use the "**DEL**" delete command to remove files for the system flash memory file system. All the files on the system are required, missing files will cause errors.

4.3.1 CHKCLUT - Check CLUT

The CHKCLUT program is used to verify that the CLUT file being used by the scanner is correct. The CLUT file is used to adjust the pixel values to the correct optical density values. If CHKCLUT reports that performance is out of specification the MKCLUT utility should be run.

The CHKCLUT program scans a special film, called the "step wedge" film. The step wedge is a film with bands of constant density across the film. A text file, called the "density file", containing a list of the actual density vales for each wedge is read. The program then compares the pixel values in the image with the "true" density values.

CHKCLUT serial_number density_tag

serial_number - system serial number, provide for compatibility, **not used**

density_tag - the unique specifier for the density filename. See the MKCLUT description.

4.3.2 MKCLUT - Make CLUT

The MKCLUT program is used to create a CLUT file from scratch. The CLUT is a lookup table that corrects the raw pixel values to there true optical density values.

The MKCLUT program scans a special film, called the “step wedge” film. The step wedge is a film with bands of constant density across the film. A text file, called the “density file”, containing a list of the actual density values for each wedge is read. The program then compares the pixel values in the image with the “true” density values. By using the differences between scanned pixel values and the true values, a correction LUT is generated. This correction LUT is the “D:\CLUT0000.DAT” written to the flash file system.

MKCLUT serial_number density_tag

serial_number - system serial number, provide for compatibility, **not used**

density_tag - the unique specifier for the density filename. The density file contains the actual optical densities of the step wedge film.

density filename = “DEN[density_tag].DAT”

Example:
MKCLUT 0000 L15
uses density file “DENL15.DAT”

4.3.3 CHKMTF - Check MTF

The CHKMTF program is used to verify that the scanner is performing within specifications. This program requires the special “MTF” test film, an 8” by 10” film with a group of vertical lines, a center black square, and a group of horizontal lines.

CHKMTF serial number

serial_number - system serial number, provide for compatibility, **not used**

4.3.4 CHKXYLIN - Check X/Y Linearity

The CHKXYLIN program is used to verify that the scanner linearity is within specifications for both the X (pixels) and Y (lines) axis. This program requires the special “Linearity” test film, a white 14” by 17” film crisscrossed by X/Y lines spaced at half inch intervals. This program detects the lines and measures there spacing.

CHKXYLIN serial number [threshold]

serial_number - system serial number, provide for compatibility, **not used**

threshold - optional threshold multiplier value (default 1.25). This option is only used in special circumstances where the lines on the XY pattern are not being detected.

4.3.5 LNADJDT - Adjust X Linearity

The LNADJDT program is used to adjust the scanner X (pixel) linearity. This program should only be used by a trained Field Service person.

4.4 Command Line Tools

The command line tools are used to enable system maintenance and diagnostics. These tools do not directly effect the scanner hardware.

4.4.1 EDDEN - Edit the Density file

The EDDEN program is used to create and modify the density files used by MKCLUT and CHKCLUT on the Internal SCSI scanner.

Command line:

EDDEN densityFile

where "densityFile" is the actual file name of the density value file. If you use MKCLUT/CHKCLUT as follows:

MKCLUT 9999 014

then the "densityFile" should be "DEN014.DAT"

example:
EDDEN den014.dat

Commands:

D num - DELETE wedge entry
num = wedge number to delete
E [num] - EDIT / Entry mode
num = optional wedge number to start editing
H - HELP display list of commands
P - PRINT display the complete list of density file values
Q - QUIT save file and end program
Note: writing a file to the Flash memory can take a long time (2+ minutes)

The following is an example of creating a new density file
Note: user inputs are in ***BOLD***

D:\>***edden den001.dat***
EDDEN: Processing density file 'den001.dat'

No DENSITY file found.
EDDEN: Could NOT find density file 'den001.dat'
Do you wish to create a new density file? [Y|N]: ***y***
Serial Number:
% lines to first step = 0.00
% lines of each wedge = 0.00
NO Wedge density information in file

D num - DELETE wedge entry
num = wedge number to delete
E [num] - EDIT / Entry mode
num = optional wedge number to start editing
H - display this message
P - print the density file values
Q - quit
Enter cmd [H,Q,P,D,E]: **e**
Enter Serial Number []: ***0123***
Enter % lines to first step [0.00]:
Enter % lines of each wedge [0.00]: ***6.5***
Enter Wedge # 1 [0.00]: ***.04***
Enter Wedge # 2 [0.00]: ***.14***
Enter Wedge # 3 [0.00]: ***.44***
Enter Wedge # 4 [0.00]: ***.35***
Enter Wedge # 5 [0.00]: ***.9***
Enter Wedge # 6 [0.00]: ***1.2***
Enter Wedge # 7 [0.00]: ***1.5***
Enter Wedge # 8 [0.00]: ***1.99***
Enter Wedge # 9 [0.00]: ***2.12***
Enter Wedge #10 [0.00]: ***2.50***
Enter Wedge #11 [0.00]: ***2.8***
Enter Wedge #12 [0.00]: ***3.01***
Enter Wedge #13 [0.00]: ***3.3***
Enter Wedge #14 [0.00]: ***3.9***
Enter Wedge #15 [0.00]: ***4.5***
Enter Wedge #16 [0.00]: *(note: a blank line ends input)*

Enter cmd [H,Q,P,D,E]: ***p***
Serial Number: 0123
% lines to first step = 0.00
% lines of each wedge = 6.50
Wedge # 1 = 0.04 Wedge # 9 = 2.12
Wedge # 2 = 0.14 Wedge #10 = 2.50
Wedge # 3 = 0.44 Wedge #11 = 2.80
Wedge # 4 = 0.35 Wedge #12 = 3.01
Wedge # 5 = 0.90 Wedge #13 = 3.30
Wedge # 6 = 1.20 Wedge #14 = 3.90
Wedge # 7 = 1.50 Wedge #15 = 4.50
Wedge # 8 = 1.99

Enter cmd [H,Q,P,D,E]: ***q***
Serial Number: 0123
% lines to first step = 0.00
% lines of each wedge = 6.50
Wedge # 1 = 0.04 Wedge # 9 = 2.12
Wedge # 2 = 0.14 Wedge #10 = 2.50
Wedge # 3 = 0.44 Wedge #11 = 2.80
Wedge # 4 = 0.35 Wedge #12 = 3.01
Wedge # 5 = 0.90 Wedge #13 = 3.30
Wedge # 6 = 1.20 Wedge #14 = 3.90
Wedge # 7 = 1.50 Wedge #15 = 4.50
Wedge # 8 = 1.99

Wedge # 3 = 0.44 >= # 4 = 0.35
Do you wish to write the density file with ERRORS? [Y/N]: ***y***
Saving values to file 'den001.dat'

Note: writing a file to the Flash memory can take a long time (2+ minutes)

The following is an example of editing the previous density file
---

D:\>***edden den001.dat***
EDDEN: Processing density file 'den001.dat'
Serial Number: 0123
% lines to first step = 0.00
% lines of each wedge = 6.50
Wedge # 1 = 0.04 Wedge # 9 = 2.12
Wedge # 2 = 0.14 Wedge #10 = 2.50
Wedge # 3 = 0.44 Wedge #11 = 2.80

Wedge # 4 = 0.35 Wedge #12 = 3.01
Wedge # 5 = 0.90 Wedge #13 = 3.30
Wedge # 6 = 1.20 Wedge #14 = 3.90
Wedge # 7 = 1.50 Wedge #15 = 4.50
Wedge # 8 = 1.99

D num - DELETE wedge entry
num = wedge number to delete
E [num] - EDIT / Entry mode
num = optional wedge number to start editing
H - display this message
P - print the density file values
Q - quit
Enter cmd [H,Q,P,D,E]: ***e 4***
Enter Wedge # 4 [0.35]: ***.75***
Enter Wedge # 5 [0.90]: ***q*** *(note: while editing a blank line will NOT end)*
Enter cmd [H,Q,P,D,E]: ***p***
Serial Number: 0123
% lines to first step = 0.00
% lines of each wedge = 6.50
Wedge # 1 = 0.04 Wedge # 9 = 2.2
Wedge # 2 = 0.14 Wedge #10 = 2.50
Wedge # 3 = 0.44 Wedge #11 = 2.80
Wedge # 4 = 0.75 Wedge #12 = 3.01
Wedge # 5 = 0.90 Wedge #13 = 3.30
Wedge # 6 = 1.20 Wedge #14 = 3.90
Wedge # 7 = 1.50 Wedge #15 = 4.50
Wedge # 8 = 1.99

Enter cmd [H,Q,P,D,E]: ***q***
Serial Number: 0123
% lines to first step = 0.00
% lines of each wedge = 6.50
Wedge # 1 = 0.04 Wedge # 9 = 2.12
Wedge # 2 = 0.14 Wedge #10 = 2.50
Wedge # 3 = 0.44 Wedge #11 = 2.80
Wedge # 4 = 0.75 Wedge #12 = 3.01
Wedge # 5 = 0.90 Wedge #13 = 3.30
Wedge # 6 = 1.20 Wedge #14 = 3.90
Wedge # 7 = 1.50 Wedge #15 = 4.50
Wedge # 8 = 1.99

Saving values to file 'den001.dat'

Note: writing a file to the Flash memory can take a long time (2+ minutes)

D:\>

4.4.2 ED - Simple Line Editor

ed - line-oriented text editor, similar to UNIX V7 ed

ED is a very simple line editor. It can be used to edit all the text files used by the internal controller system, even the density file normally edited by EDDEN. Normally ED is only used to modify the LSDTCNFG.DAT file.

4.4.2.1 ED Syntax

ed [existing-file]

existing-file Only an existing file can be opened. Otherwise a nameless edit buffer is opened; a name can be used with the 'f' or 'w' commands.

As a line editor, ed operates in one of two modes: COMMAND mode, in which a colon is displayed at the screen's bottom to prompt for a command; and INPUT mode, in which all keyboard input is added to the file (edit buffer). From COMMAND mode, INPUT mode is entered by either the 'i' or 'a' commands. From INPUT mode, the COMMAND mode is restored by entering a line consisting of a single period by itself. If such a line is desired in the file, it can be created by entering (for instance) two periods, then using the 's' command to change these to only one period.

A command consists of an optional line-range specification, a single character indicating the command, and for some commands an optional third argument. The line-range specification is either a single line number or a first-line number and a last-line number separated by a comma. The character '^' means the first line of the file; '$' means the last line of the file.
If the input command does not process correctly the "Oops" error message will be displayed.

4.4.2.2 ED Commands

<newline>
If a line is specified, make that the new current line.
Otherwise advance the current-line-pointer by one line.

= Print the line number of the current line.

. (by itself) Print the current line.

- (by itself) Move the current-line-pointer back one, and print the new current line.
+ (by itself) Move the current-line-pointer forward one, and print the new current line.
! Execute a shell command and return.
a Go into INPUT mode with a new line following the current line. (INPUT mode is terminated by an input line containing only a period in the first column.)
i Go into INPUT mode with a new line preceding the current line. (INPUT mode is terminated by an input line containing only a period in the first column.)
c Delete the specified lines (or the current line) and then add new lines in their place. This is equivalent to a 'd' command followed by an 'i' command.
d Delete the specified range of lines (or the current line). Leave the current-line-pointer at the following line.
e Clear the edit buffer and begin editing a new file. This command fails if the buffer contains changes (or new lines) which have not been written out. To discard these changes and edit a new file, use 'E' instead of 'e'.
E Clear the edit buffer and begin editing a new file, regardless of any changes to the current edit buffer.
f Print the filename, or set it to a new name if specified.
j Join the addressed lines together (or the current line to the previous line).
k Mark the addressed line with the specified letter. Example: '17ka' puts mark "a" on line 17.
l List the addressed lines, showing all non-printing characters and indicating the end-of-line.
m Move the specified range of lines to follow the line number given. Example: '5,7m3' moves lines 5 through 7 "up", to follow line 3.
p,P Print the specified lines.
q Quit the editor. This fails if the edit buffer contains any changes. If so, use 'Q' instead.
Q Quit the editor absolutely. Any changes are discarded.
r Read in a file, adding it after the current line.
s Substitute text on the current line. Example: 's/alpha/beta/' finds the string "alpha" and replaces it with "beta".
t Transfer (copy) the specified range of lines to follow the line number given. Example: '5,7t7' puts a copy of lines 5 through 7 after line 7.
w,W Write the edit buffer out. If a filename is given, it is used and becomes the current filename. If a range of lines is specified, only those lines are written.

x Write the entire buffer out to its file, and terminate.

z Print 21 lines. '-', '.', or '+' may be given, and mean
"start 21 lines previous, end at current line",
"start 11 lines previous, end 10 lines hence", or
"start at current line, end 21 lines from here", respectively.